5C.2 TESTING OF A REVISED MODEL TRACK PREDICTION EVALUATION EXPERT SYSTEM

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1. MOTIVATION

The U. S. Weather Research Program Hurricane Landfall has sponsored the Joint Hurricane Testbed program to facilitate a transition of research toward operations at the Tropical Prediction Center/National Hurricane Center (NHC). This paper describes the effort during the 2003 hurricane season for producing a dynamical model expert system module for evaluating tropical cyclone track predictions in the Atlantic and eastern Pacific. This project is to adapt for use in these basins a similar expert system for the western North Pacific that has been used successfully at the Joint Typhoon Warning Center, Hawaii. It follows two years worth of testing during the 2001 and 2002 seasons, and lessons learned during those two seasons were applied.

2. METHODOLOGY

2.1 *Data*

The five dynamical model tracks and predicted fields utilized in the Atlantic and eastern Pacific system were: NCEP Global Forecast System (GFS) and Geophysical Fluid Dynamics Lab (GFDL) models, U. S. Navy Operational Global Atmospheric Prediction System (NOGAPS) and Navy version of the GFDL model (called GFDN), and the UK Met Office (UKMO) global model. The consensus of these five models is called the non-selective consensus (NCON). A forecaster utilizing the Dynamical Model Evaluation System (DYMES) follows an established procedure to determine if the current scenario warrants rejecting one or more models that are most likely erroneous to create an improved selective consensus (SCON).

2.2 *Model Traits Knowledge Base*

Application of DYMES during the 2002 Atlantic season ended with mixed results. Nearly half of the 72-h SCON forecasts were actually worse than NCON. Post-season analysis determined that the chief handicap to the system was the application of western North Pacific model traits. In contrast to the substantial zonal jet and subtropical ridge of the western North Pacific, the Atlantic is characterized by high amplitude midlatitude troughs and ridges, and models tend to be degraded more commonly by misrepresentations of these midlatitude features. Prior to the 2003 season, error mechanisms involving midlatitude processes were identified as common and included in the guidance provided by DYMES, thereby allowing a forecaster to more likely identify the proper mechanism affecting a particular model. As a guide to the forecaster, DYMES objectively provides guidance to the forecaster as to which error mechanism may be degrading a particular model forecast track. For example, DYMES uses the options in Figure 1 to help determine what error mechanisms may be degrading models for storms that are expected to remain in the tropics for the next three days.

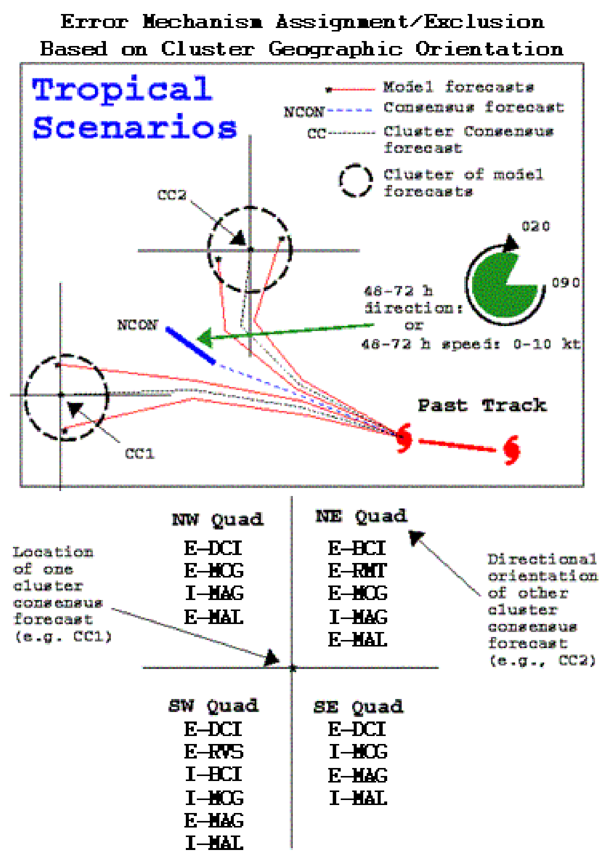

Fig. 1: Given a forecast scenario with two clusters of forecast model tracks, one to the northeast relative to another to the southwest, DYMES narrows the possible error mechanisms down to five (six) for the northeastern (southwestern) cluster. All error mechanisms which have an “M” as the second letter are associated with misrepresentations of midlatitude features. Both of the clusters in this case have three such error mechanisms. For example, the tracks in the northeastern cluster could be degraded by the following processes: E-MCG, I-MCG, and E-MAL.

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3. RESULTS

3.1 Structure and Intensity

Initial findings indicate that track differences were often directly related to different depictions of the structure, especially intensity, of the TC. In particular, the TC in the GFS was often depicted as much weaker than in other models. How this difference affected the resultant track errors varied from case to case. Also related to the structure of the TC in the model, a high number of forecasts were degraded by a bad tracker.

3.2 Utilization

A forecast scenario in which the 72h forecast position of at least one of the available model tracks is more than 225 n mi from the consensus of an ensemble of at least three of the five models is defined as large spread. In large spread scenarios, at least one of the models is guaranteed to have a large error. During the 2003 Atlantic (eastern Pacific) hurricane season, track prediction by the models was relatively good; however, roughly 18% (28%) of the verifying 72h forecast scenarios were large spread cases. In such cases, the forecaster could simply accept all available models or reject suspected erroneous models to make a hopefully improved selective consensus. A lesson learned from the 2002 season (that only reinforced what had already been observed in the western North Pacific) was that the DYMES starting point, NCON, is already a good forecast, and creating an SCON that improves upon NCON is only possible about 12% of the time. An analysis of the maximum potential of DYMES versus the realistic value added for the 2003 Atlantic and eastern Pacific season will be presented.

Acknowledgment. The original expert system was developed with funding from the Office of Naval Research Marine Meteorology Program and the Space and Naval Warfare Command. The US Weather Research Program has funded the adaptation to the Atlantic and eastern Pacific.